The present invention is directed to a thermal transfer roller having an outer cylindrical shell which contacts a substrate being heated or cooled, and an inner cylindrical shell which is coaxially positioned within the outer shell to define an annulus between the inner cylindrical shell and the outer cylindrical shell through which heat transfer fluid may flow.

As shown in Figs. 1 and 2, the thermal transfer roller also includes a roll journal on one or both ends of the thermal transfer roller and a passage extending along a central axis of the thermal transfer roller between an inlet end of the thermal transfer roller and an outlet end of the thermal transfer roller. The passage transfers heat transfer fluid from the outlet end to the inlet end and is in fluidic communication with the annulus.

The present invention provides walls having a uniform thickness, which define a plurality of channels extending radially outwardly from the passage to the annulus; each channel becoming progressively wider as it approaches the annulus. As each channel transitions into the annulus, a large transition area is provided by the widened channels to allow fluid to flow into the annulus. As set forth in the Specification at page 11, line 17 through page 12, line 13:

> "The purpose of channels 46 is to substantially prevent the heat transfer fluid from assuming an angular or spiral flow pattern within the end chamber, particularly within the inlet chamber 28, due to rotation of the roller. Angular flow patterns in the end chambers (particularly

inlet chamber 28) cause increased fluid pressure and reduce the volume of fluid delivered by a typical constant-pressure fluid pump. The tendency for angular or spiral fluid flow increases with roller velocity, causing further pressure increase and further reduction in fluid volume. By substantially reducing angular or spiral flow within the end chambers, the drop in fluid volume (and heat transfer) at higher roller velocities is substantially diminished.

The channels 46 are also designed to facilitate a substantially uniform, even discharge of fluid into cylindrical slot 34 entering the annulus 16 (Fig. 2) or into numerous smaller openings 35 entering the annulus 16 (Fig. 1). This is accomplished in part by providing channels 46 with a wider end approaching the annulus, and a narrower end approaching the journal 24. This configuration permits the channels to be immediately adjacent or very close to each other at both ends, and minimizes the amount of space not occupied by channels. By minimizing the distance between adjacent channels approaching the annulus, a substantially even fluid discharge around the circumference of the annulus is maintained."

Claim Rejections - 35 U.S.C. §103

The rejection of Claims 1-25 under 35 U.S.C. §103 as being unpatentable over U.S. Patent 5,292,298 ("Scannell") in view of U.S. Patent 4,658,486 ("Schönemann") or U.S. Patent 5,887,644 ("Akiyoshi et al.") or U.S. Patent 5,899,264 ("Marschke") is respectfully traversed, particularly in view of the following remarks.

Scannell has been improperly combined with Schönemann or Akiyoshi et al. or Marschke. None of the prior art references suggests or implies the proposed inclusion of "a passage between the inlet and outlet ends of a roller for the purpose

of saving space and manufacturing costs...," and the Examiner has pointed to no suggestion anywhere in the art for combining these references.

"When a rejection depends on a combination of prior art references, there must be some teaching, suggestion, or motivation to combine the references." In re Rouffet, 47 U.S.P.Q.2d 1453, 1456 (CAFC 1998). It is the Examiner that must show that there is a motivation to combine the references. In re Rouffet, 47 U.S.P.Q. at 1457-1458. In addition to the suggestion to combine the references, there must also be a reasonable expectation of success to those of ordinary skill in the art. "Both the suggestion and the reasonable expectation of success must be founded in the prior art." In re Vaeck, 20 U.S.P.Q.2d 1438, 1442 (CAFC 1991). Further, if a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

In the Office Action mailed 29 June 2001, the Examiner alleges that "Scannell in Figures 1-3 and 5 discloses all the claimed features with the exception of the passage extending between the inlet and outlet ends of the roller" and identifies a motivation to combine Scannell with Schönemann or Akiyoshi et al. or Marschke because "Schönemann, Akiyoshi et al. and Marschke disclose that it is known to have a passage between the inlet and outlet ends of a roller for the purpose of saving space

and manufacturing costs (i.e. using less tubing in the plumbing of the fluid supply and removal system) by delivering and removing a fluid to and from only one end of the roller." The Examiner concludes that it would have been obvious at the time the invention was made to a person having ordinary skill in the art to employ in Scannell a passage between the inlet end and the outlet end of the thermal transfer roller for the purpose of saving space and manufacturing costs by delivering and removing a heat transfer fluid to and from only one end of the thermal transfer roller, as disclosed in Schönemann, Akiyoshi et al. and Marschke. However, this purported motivation would not lead an ordinary person skilled in the art to combine Scannell with Schönemann, Akiyoshi et al. or Marschke to arrive at Applicants' claimed invention.

Applicants are not seeking to provide a passage between the inlet and outlet ends of the thermal transfer roller for the purpose of saving space and manufacturing costs. Instead, as explained above, Applicants seek to overcome the problems associated with angular or spiral fluid patterns assumed by the heat transfer fluid in the end chamber and with uneven fluid distribution around the circumference of the annulus. The present invention overcomes these problems by providing a plurality of channels extending radially outwardly from the passage to the annulus; each channel becoming progressively wider as it approaches the annulus. As each

channel transitions into the annulus, a large transition area is provided by the widened channels to allow fluid to flow into the annulus.

Further, the combination of references relied upon by the Examiner, if proper, would not render Applicants' claimed invention obvious in the manner required by 35 U.S.C. §103. Scannell, alone or in combination with Schönemann, Akiyoshi et al. or Marschke, does not teach or suggest a plurality of channels which extend radially outwardly from the passage to the annulus, wherein each channel becomes progressively wider as it approaches the annulus, as claimed. Further, the prior art references provide no motivation to one having ordinary skill in the art of thermal transfer rollers to combine the teachings in the prior art references for the purpose of preventing angular or spiral flow patterns and/or improving the fluid distribution about the annulus.

Scannell

Scannell discloses a heat transfer roll 10 wherein fluid may flow between a spiral channel 19 and an axial bore 29, 80 of an axial shaft 28, 78 by passing through a hole 44 in the inner tubular body 12. In one embodiment, Scannell teaches a plurality of radial bores 40 each aligned with a hole 44 to provide fluid communication between the axial bore 29 and each spiral channel 19. A blind bore 50 intersects each radial bore 40, as shown in Figs. 3, 4a and 4b. A cylindrical plug

may be inserted into each blind bore 50 to block the associated bore 40 and prevent flow of liquid therethrough. Scannell at Col. 4, line 41 through Col. 5, line 17.

In an alternative embodiment, a plurality of transverse bores 90 extend through the outer plate 70 and between long and short radial spacers 74, 88 associated with one hole 44. As shown in Fig. 6, the constriction between long and short radial spacers 74, 88 can be blocked by inserting a plug 58 in the transverse hole 90 to block the constriction between the long and short radial spacers 74, 88. Scannell at Col. 6, lines 5-26.

In all embodiments of Scannell, when all but one hole 50, 90 have been plugged or blocked, a cleaning fluid is injected into the axial bore 29, 80 of the roll 10 and directed into the single channel 19 which remains unblocked. Thus, each channel 19 can be cleaned individually; the roll 10 can be descaled and serviced with a minimum of time and expense.

Scannell does not teach or provide any motivation to include a passage between the inlet and outlet ends of the roller for the purpose of saving space and manufacturing costs. In fact, Scannell cannot be combined with the cited prior art references for the proposed modification without rendering the roller as taught in Scannell useless for the intended purpose. Further, Scannell does not suggest nor provide any motivation for having a plurality of channels which progressively widen

as the channels approach the annulus to reduce angular or spiral fluid flow and provide a substantially uniform and even distribution of fluid. Rather, Scannell teaches away from such configuration by teaching the use of a plurality of spiral channels 19 in the roll 10 to provide fluid communication with an axial bore through an associated bore 44, whereby the fluid communication can be blocked by insertion of a plug into an interesting bore 50, 90. Thus, the fluid must travel through a small, constricted area, i.e. the bore 44. One skilled in the art of thermal transfer rollers would not be motivated to combine Scannell with any prior art reference cited by the Examiner to arrive at Applicants' claimed invention.

Scannell in View of Schönemann

Schönemann discloses a calender roll 1 having a body 2 provided with a flange journal stub 5 at each end thereof. Each flange journal stub 5 is bolted or screwed to the roll body 2 so that a boss 8 fits snugly within a recess 9. Annular gaps 10 and 11 are defined between an end face 8a of the boss 8 and an end face 9a of the recess 9. The ends of an axial passages 4 open into these annular gaps and communicate with axial bores 12 and 13 extending through the respective flange journal stub 5.

Schönemann discloses that in order to reduce costs and to provide the heating medium so that it only heated the regions of interest, conventional calender

rolls were developed which had a hollow interior and were connected at one end with appropriate fittings for feeding the medium to and removing the medium from the hollow calender roll. However, such conventional calender rolls had a problem with respect to acceleration and velocity of the calender roll. As the calender roll accelerated or was rotated at high speed, the baffle arrangements within the hollow calender roll tended to loosen and become liberated creating significant maintenance problems and down time. See Schönemann at Col. 1, line 39-59. Thus, Schönemann actually teaches away from combining an axial passage as taught in Schönemann with a hollow roller, such as taught in Scannell and the present invention.

Additionally, the flange journal stub 5 of Schönemann cannot be combined with the teachings of Scannell without rendering Scannell unsatisfactory for its intended purpose of providing a heat transfer roll having spiral channels which can be easily cleaned independently. If the flange journal stub 5 providing an annular gap 10 or 11 is combined with the heat transfer roll 10 of Scannell, fluid communication between the axial bore and each spiral channels 19 cannot be blocked by the use of a plug, as taught in Scannell. Thus, such combination is an improper combination of prior art references for rejecting the claims under 35 U.S.C. §103. *In re Gordon.*

Finally, Schönemann does not teach or suggest having a plurality of channels which progressively widen as the channels approach the annulus to reduce angular or spiral fluid flow and provide a substantially uniform and even distribution of fluid. In fact, Schönemann teaches away from the use of baffles (See Schönemann at Col. 7 lines 26-33). Further, contrary to the teachings of the present invention, Schönemann teaches away from heating the calender roll uniformly over its entire length (See Schönemann at Col. 7, lines 37-41).

Scannell in View of Akiyoshi et al.

Contrary to the Examiner's contention, Akiyoshi et al. provides no motivation to combine Scannell with Akiyoshi et al. to provide a passage between the inlet and outlet ends of a roller for the purpose of saving space and manufacturing costs. Akiyoshi et al. does not suggest or imply the proposed inclusion of "a passage between the inlet and outlet ends of a roller for the purpose of saving space and manufacturing costs." Thus, it would not have been obvious at the time the invention was made to a person having ordinary skill in the art to employ in Scannell a passage between the inlet end and the outlet end of the thermal transfer roller for the purpose of saving space and manufacturing costs by delivering and removing a heat transfer fluid to and from only one end of the thermal transfer roller.

Akiyoshi et al. discloses a casting roll for the casting of metal strips, wherein a plurality of distribution passages 30 extend radially outwardly from an end of a bore 28. Each of the distribution passages 30 is connected to a corresponding cooling water passage 25, which incidently can be formed simply by machining the grooves on the sleeve to facilitate and contribute to reducing manufacturing costs.

Alternatively, the combination of Scannell with Akiyoshi et al., if proper, would not render Applicants' claimed invention obvious in the manner required by 35 U.S.C. §103. Akiyoshi et al. does not teach or suggest having a plurality of channels which progressively widen as the channels approach the annulus to reduce angular or spiral fluid flow and provide a substantially uniform and even distribution of fluid.

Scannell in View of Marschke

Contrary to the Examiner's contention, Marschke provides no motivation to combine Scannell with Marschke to provide a passage between the inlet and outlet ends of a roller for the purpose of saving space and manufacturing costs. Marschke does not suggest or imply the proposed inclusion of "a passage between the inlet and outlet ends of a roller for the purpose of saving space and manufacturing costs." Thus, it would not have been obvious at the time the invention was made to a person having ordinary skill in the art to employ in Scannell a passage between the

inlet end and the outlet end of the thermal transfer roller for the purpose of saving space and manufacturing costs by delivering and removing a heat transfer fluid to and from only one end of the thermal transfer roller.

Marschke discloses a steam heated corrugating roll 10 having an end wall with a series of steam transfer bores 36 which are circumferentially spaced around the roll axis and extend radially through spokes 49 between a shaft opening 35 and a steam header 36. Steam travels along steam tubes 16 and condensate is collected at a return end wall 40. The return end wall 40 has condensate transfer bores 41 which are spaced circumferentially around the roll axis and extend from bore openings in the inner shoulder 42 to condensate ports 43.

Alternatively, the combination of Scannell with Marschke, if proper, would not render Applicants' claimed invention obvious in the manner required by 35 U.S.C. §103. Marschke does not teach or suggest having a plurality of channels which progressively widen as the channels approach the annulus to reduce angular or spiral fluid flow and provide a substantially uniform and even distribution of fluid.

Therefore, the Examiner improperly used hindsight to combine Scannell with Schönemann or Akiyoshi et al. or Marschke to reject Claims 1-25 under 35 U.S.C. §103(a). There is no suggestion or motivation in the art to combine them, and no reference reveals a reasonable expectation of success, to a person with ordinary

skill in the art. In re Vaeck, 20 U.S.P.Q.2d at 1444. For this additional reason, the rejection should be withdrawn.

In summary, it is urged that the combination of Scannell with Schönemann, Akiyoshi et al. or Marschke relied upon for rejection is improper and further that the combination of references relied upon, if proper, would not render Applicants' claimed invention obvious in the manner required by 35 U.S.C. §103. Thus, Applicants respectfully request withdrawal of the rejection of Claims 1-25 under 35 U.S.C. §103 as being unpatentable over Scannell in view of Schönemann or Akiyoshi et al. or Marschke.

CONCLUSION

Applicants intend to be fully responsive to the outstanding Office Action. If the Primary Examiner detects any issue which the Primary Examiner believes Applicants have not addressed in this response, Applicants' undersigned attorney requests a telephone interview with the Examiner. The undersigned can be reached at (847) 490-1400.

In view of the above remarks, Applicants sincerely believe that Claims 1-25 of this patent application are now in condition for allowance and, thus, respectfully request early allowance.

Respectfully submitted,

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